FLOWER-VISITING RECORDS OF THE NATIVE BEES OF NEW CALEDONIA[1]

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ABSTRACT

The flower-visiting records for the 43 species of bees considered to be native to New Caledonia show that females of 21 species visited 116 native species of plants in 69 genera and 41 families, and the bees were documented to carry pollen from 64 species and possibly four more. The plant families with the greatest number of species documented for visits by female bees were, in descending order: Myrtaceae (21), Dilleniaceae (10), Cunoniaceae (nine), Araliaceae (seven), Fabaceae (seven, encompassing the Caesalpinioideae, Mimosoideae, and Papilionoideae), Goodeniaceae (five), Proteaceae (five), Apocynaceae (four), Sapindaceae (four), and remaining families with one to three species. Females of six and possibly one more species carried pollen from each of Dilleniaceae and Myrtaceae, six carried pollen from Araliaceae, five from Goodeniaceae, four and possibly one more from Cunoniaceae, four from each of Fabaceae and Sapindaceae, and none to three from the remaining 34 families observed. For introduced plants, female bees of 12 species visited 54 species in 43 genera among 19 plant families and were documented to carry pollen from 31 and possibly one more species. For introduced plants, families with the highest number of species visited by female bees, in descending order, were: Asteraceae (12); Fabaceae (eight); Verbenaceae (seven); and Euphorbiaceae, Myrtaceae, and Solanaceae each with three. The remaining 13 families had either one or two species visited by bees. Females of seven species of bees carried pollen from Fabaceae, six from Asteraceae, three each from Myrtaceae and Solanaceae, and none to "2 + 1?" (two or possibly three) from remaining families. Only half a dozen species of native bees can be considered to be common, in that they can be expected to be observed reasonably regularly on a range of flowers. The ubiquitous introduced honey bee *Apis mellifera* L. and its constant foraging for nectar and pollen on a very wide range of flowers may outcompete many species of native bees, potentially reducing their numbers, and consequently obscuring their relationships with the flora.

Key words: Apis, Araliaceae, competitive foraging pressure, Cunoniaceae, Dilleniaceae, Fabaceae, flower-visiting records, Goodeniaceae, introduced honey bee, Myrtaceae, native bees, New Caledonia, Proteaceae.

For a land mass of 19,103 km^2, New Caledonia is considered unique based on the high number of flowering plant species (3051) and its high endemicity (77.7%; Morat et al., 2012), which markedly contrasts with the low number of bee species (28 species, Donovan, 1983; 21 species, Pauly & Munzinger, 2003). A major question for evolutionary biologists is how so many distinctive species of flowering plants could have evolved with so few apparent pollinating bees. This includes a relative paucity of other pollinating insects, birds, and reptiles (Kato & Kawakita, 2004). In contrast, the number of known species of bees has about doubled in recent years. Taxonomic revisions of the major bee groups are currently underway, but will be time consuming, and yet there is much interest in the relationships between the various species of bees and flowering plants. The purpose of this study is to make available now all bee flower-visiting data. Observations for *Apis mellifera* L. are explicitly excluded because this honey bee was purposely introduced in 1848 (Lamaignere, 2001) and is not a naturally occurring constituent of the flower-visiting Apoidea. The term "native" for the remaining species of bees is used here to indicate those species that were likely present before the arrival of any humans about several thousand years ago (Irwin, 2010), and also those that might not have been knowingly introduced by humans. However, in the absence of intensive surveys of the bees of lands of the Southwest Pacific,

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[1] We thank the Missouri Botanical Garden and the John D. and Catherine T. MacArthur Foundation for funding bee and plant collecting on New Caledonia by Gordon McPherson, Barry Donovan, Jason Bradford, and Helen Fortune, and we thank Jason Bradford and Helen Fortune for some plant identifications. Some bees were collected in the Kouakoué-Ni reserve during a botanical assessment supported by a National Geographic Society grant N°7579-04 to Jérôme Munzinger. The preparation of this manuscript was suggested by Dr. Peter Raven. Finally, we thank North and South Environmental Services in New Caledonia for collecting permits and logistic support.

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doi: 10.3417/2010076

ANN. MISSOURI BOT. GARD. 99: 19–43. PUBLISHED ON 19 JULY 2013.

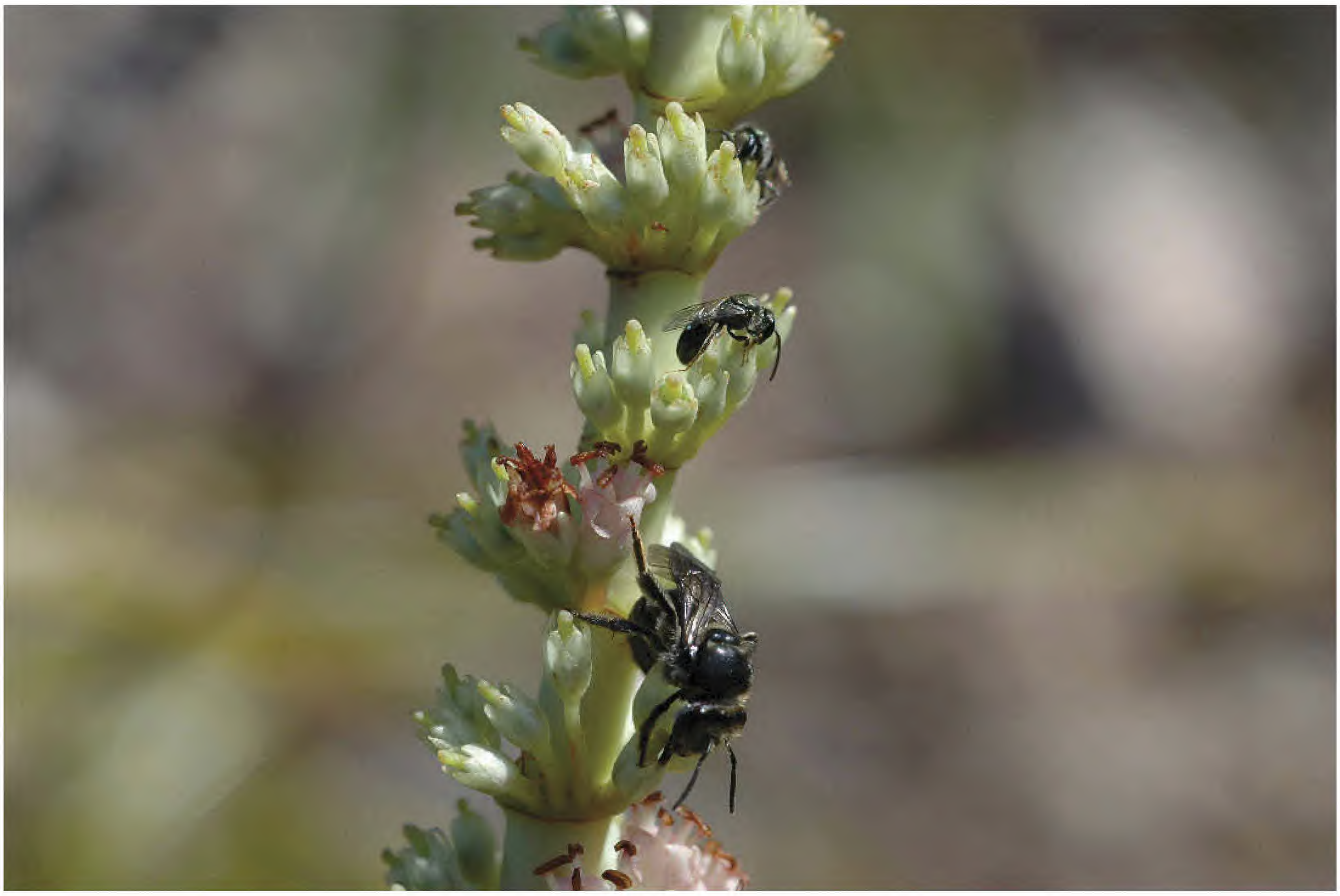

Figure 1. Two female *Homalictus risbeci* (Cockerell, 1929) (the two small bees) and a female *Austronomia sicheli* (Vachal, 1897) (the large bee) visiting the flowers of *Dracophyllum verticillatum* Labill (Ericaceae), Col d'Arama, New Caledonia, 29 July 2005. Photograph by J. Munzinger.

the true status of many species may be uncertain (Groom & Schwarz, 2011).

METHODS

Bees from New Caledonia from all known collections worldwide were borrowed, and flower data were recorded from labels attached to the pins. In addition, bees were collected with insect nets from flowers on Grande Terre during December 1979 and April to May 1981, and Grande Terre and Ile des Pins during October 1980 by B. J. Donovan and G. McPherson; on Grande Terre during January and May 1999, March to April 2001, November to December 2001, November to December 2002, and January 2004 by J. Munzinger; on Grande Terre during November to December 2000 by B. J. Donovan, H. Fortune, and J. Bradford; and Grande Terre and Lifou during July to August 2003 by B. J. Donovan. Since April 2004 to September 2008, bees have been collected at various times of year throughout New Caledonia by J. Munzinger (Fig. 1). The identity of flowers from which bees were collected was recorded on site, or if the flower could not be identified, specimens were taken for later study and identification; these vouchers were deposited in the herbaria of MO and NOU.

Bees were examined microscopically and where possible were identified to species, or if identification was not possible, numbered as separate taxa. The names of species of bees are as in Michener (2007), with the exception of the insect genus *Lipotriches* Gerstaecker, which is now referred to as *Austronomia* Michener. In Tables 1 and 3, the families, genera, and species of bees are ordered as in Michener (2007). As revisions of groups of bees are published (Donovan, in prep.; Pauly, in prep.), references in those works will be made to the species that are numbered in this study. For all species of bees, holotypes were examined wherever possible, and for species of bees named from areas beyond New Caledonia, voucher specimens were examined from New Caledonia. Data for voucher specimens are presented after the holotype data. Female bees were examined microscopically for evidence of pollen in scopae. When pollen is abundant the bee has obviously been collecting pollen for a while, but if a bee has just begun collecting pollen, very little may be evident. If scopae held very little pollen and it was no more abundant than on other parts of the bee, the bee was not considered to have been collecting pollen. However, if the pollen in scopae was at least partly clumped, the bee was considered to have been collecting pollen. Female hylaeine and euryglossine bees carry pollen internally, so if they were captured in association with flowers, whether they were collecting pollen could not be readily ascertained. Females of an undescribed cleptoparasitic species, which is referred to in Tables 1 and 3 as "*Lasioglossum* sp. indet. 9," do not carry pollen. Notations such as "2/5 p" (Table 1) indicate that there were two collections of a total of five bees, all of which were carrying pollen, while "2/5 (1/3 p)" refers to two collections of a total of five bees, of which one collection of three bees was carrying pollen. The notation "0/1" indicates that one bee was observed on a flower. In this article, a notation such as "4 + 1?" means that females of four species of bees were carrying pollen, and possibly also the females of one species that carry pollen internally. A "collection" refers to an event during which bees were captured, and differs from another "collection" in at least one datum, such as the collector, the host plant, the site, or time of day. Because bees can fly rapidly, will sometimes visit a range of flowers, and may take just nectar and not also pollen from a flower, the collection from a particular flower of a bee that is carrying pollen does not necessarily mean that the pollen is from that flower. Microscopic examination of pollen on bees to identify the source of the pollen was beyond the scope of this study.

Female bees that collect much pollen from the flowers of a particular species of plant are often considered to be pollinating the flowers, but their true status as pollinators can be determined only by assessing the number of pollen grains deposited on stigmas. In contrast to female bees, male bees do not collect pollen to carry to nests, and they visit flowers comparatively fleetingly only to sup nectar and perhaps to feed on pollen grains. Compared to female bees, male bees are therefore far less likely to be effective pollinators.

Native plant names follow Jaffré et al. (2004), or the updated version of this checklist (Morat et al., 2012). Information presented here includes sources such as Donovan (1983), Pauly and Munzinger (2003), Nielsen et al. (2005), and Kato and Kawakita (2004).

RESULTS

Forty-three species of native bees were identified from New Caledonia, and of these the females of 21 species visited the flowers of 116 native species of plants in 69 genera and 41 families (Tables 1 and 2). Twenty-one of these plant species belonged to the Myrtaceae, 10 to Dilleniaceae, nine to Cunoniaceae, seven each to Araliaceae and Fabaceae s.l. (including the Caesalpinioideae, Mimosoideae, and Papilionoideae), five each to Goodeniaceae and Proteaceae, and four each to Apocynaceae and Sapindaceae, while for the remaining families the number of species ranged from one to three. Species in Dilleniaceae and Myrtaceae were each visited by females of nine species of bees; Araliaceae by eight; Cunoniaceae and Ericaceae each by seven species; Goodeniaceae by six species; Arecaceae, Fabaceae, Proteaceae, and Violaceae each by five species; and the remaining families were visited by one to four species. Females of "6 + 1?" species of bees carried pollen from Dilleniaceae and Myrtaceae, six from Araliaceae, five from Goodeniaceae, "4 + 1?" from Cunoniaceae, four each from Fabaceae and Sapindaceae, and none to three from the remaining 34 families. Bees carried pollen from "64 + 4?" plant species, of which 11 belonged to Myrtaceae; six to Fabaceae; "5 + 2?" to Dilleniaceae; "4 + 1?" to Cunoniaceae; four to each of Araliaceae, Goodeniaceae, Proteaceae, and Sapindaceae; and none to two for the remaining families.

For introduced plants, female bees of 12 species visited 54 species in 43 genera and 19 families (Tables 1 and 2). Twelve of the plant species belonged to Asteraceae; eight to Fabaceae; seven to Verbenaceae; three each to Euphorbiaceae, Myrtaceae, and Solanaceae; and from one to two for the remaining families. Species in Fabaceae were visited by females of eight species of bees, Asteraceae and Verbenaceae by seven, Sapindaceae by four, and the remaining families by one to three. The females of seven species of bees visiting Fabaceae carried pollen, six carried pollen from Asteraceae, three carried pollen from each of Myrtaceae and Solanaceae, while none to "2 + 1?" carried pollen from the remaining families. Pollen was carried by female bees from six species of plants in both Asteraceae and Fabaceae, three in Solanaceae, and none to two in the remaining families.

One species each of Asteraceae and Convolvulaceae are of uncertain identity (Table 2) and were visited by females of three species of bees.

For species of bees with females that visited the flowers of native plants, of the six species with more than 10 records, *Austronomia sicheli* Vachal visited most species (53 spp.) and carried pollen from the highest number (29 spp.) (Table 3). However, for introduced plants only three species of bees visited 10 or more species, of which *Homalictus aponi* Cheesman & Perkins visited the most species (24 spp.) and carried pollen from the most species (14 spp.).

DISCUSSION

Although the 43 native species of bees now known from New Caledonia are nearing double the mean of

Table 1. Alphabetic list of families, subfamilies, genera, and species of bees, bee voucher and bee collection data, and the vascular plants associated with each bee species.

Bee family, subfamily, tribe, genus, and species	Site of bee holotype and/or bee voucher information	Plant origin	Plant family
Colletidae			
Colletinae			
Leioproctus pacificus Michener (1965), subg. *Lamprocolletes* Smith	New Caledonia, Nepoui Valley, July 1940, *F. X. Williams*, *s.n.*, holotype ♂, BPBM	native	Araliaceae
		native	Celastraceae
Leioproctus Smith, 1853, sp. indet. 2, aff. subg. *Lamprocolletes*	New Caledonia, Mt. Khogis (*sic*), 1 ♂, 1 Nov. 1992, *E. & M. Schlinger s.n.*, INHS		–
Hylaeinae			
Hylaeus Fabricius sp. indet. 1	New Caledonia, Ouen Toro Noumea, 1 ♀, 15 Jan. 1972, *P. Cochereau s.n.*, MNHNP		–
Hylaeus sp. indet. 2	New Caledonia, Port Laguerre, 1 ♀, 11 Apr. 2001, *J. Munzinger s.n.*, MNHNP		–
Hylaeus sp. indet. 3	New Caledonia, Forêt de Sailles, 1 ♀, 3 Dec. 2001, *J. Munzinger s.n.*, MNHNP		–
Palaeorhiza flavomellea Cockerell, 1910, subg. *Heterorhiza* Cockerell	Queensland, Australia, Cocotier Noumea, 1 ♀, 1 ♂, 27 May 1977, *A. Delobel s.n.*, MNHNP	native	Arecaceae
		native	Elaeocarpaceae
		native	Hernandiaceae
		native	
		introduced	Anacardiaceae
		introduced	
		introduced	Combretaceae
Euryglossinae			
Euhesma Michener sp. indet. 1	New Caledonia, Mt. Koghi, 1 ♂, 4–6 Oct. 1967, *M. Sedlacek s.n.*, BPBM	native	Cunoniaceae
		native	Dilleniaceae
		native	
		native	
		native	Myrtaceae
Euryglossina Cockerell sp. indet. 1	New Caledonia, 1 ♀, 1 ♂, 3 July 1980, *G. McPherson s.n.*, BJD	introduced	Sapindaceae
Euryglossina sp. indet. 2	New Caledonia, 2♀, Forêt de Sailles, 9 Dec. 2001, *J. Munzinger s.n.*, MNHNP		–
Halictidae			
Halictinae			
Homalictus aponi (Cheesman & Perkins, 1939)	Vanuatu, Malekula Island, St. Louis, 14 ♀, 1 ♂, 17 Aug. 1940, *F. X. Williams s.n.*, IRD	native	Araliaceae
		native	Asteraceae
		native	Cunoniaceae
		native	
		native	Dilleniaceae
		native	
		native	
		native	
		native	
		native	

Table 1. Extended.

Plant species	Plant voucher information	Bee collection data	
		♀	♂
Myodocarpus fraxinifolius Brongn. & Gris		–	♂ 1/2
Peripterygia marginata (Baill.) Loes.		♀ 1/1	–
–		–	–
–		–	–
–		–	–
–		–	–
Cocos nucifera L.		♀ 2/3	♂ 2/5
Elaeocarpus angustifolius Blume		–	♂ 1/1
Hernandia nymphaeifolia (C. Pres.) Kubitzki		–	♂ 5/5
Hernandia ovigera L.		–	♂ 1/5
Mangifera indica L.		–	♂ 1/3
Schinus terebinthifolia Raddi		–	♂ 3/10
Terminalia catappa L.		–	♂ 1/2
Codia albifrons (Brongn. ex Schinz & Guillaumin) Vieill. ex Guillaumin		♀ 1/2	–
Hibbertia heterotricha Bureau ex Guillaumin		♀ 1/1	–
Hibbertia pulchella (Brongn. & Gris) Schltr.		♀ 1/1	–
Hibbertia Andrews sp. indet.		♀ 1/5	–
Syzygium quadrangulare Guillaumin		♀ 1/5	–
Litchi chinensis Sonn.		♀ 1/1	♂ 1/1
–		–	–
Polyscias J. R. Forst. & G. Forst. sp. indet.		♀ 1/1 p	♂ 1/1
Blumea lacera (Burm. f.) DC.		♀ 1/1	–
Geissois Labill. sp. indet.		–	♂ 1/1
Pancheria billardierei (D. Don) Pamp.	*G. McPherson 3339*, MO	♀ 1/1 p	–
Hibbertia deplancheana Bureau ex Guillaumin		♀ 4/4 (2/2 p)	–
Hibbertia lucens Brong. & Gris. ex Sebert & Pancher	(1 ♀ p) *G. McPherson 3272*, MO; (3 ♀ p) *J. Munzinger 2527*, NOU	♀ 4/4 p	–
Hibbertia podocarpifolia Schltr.			
Hibbertia pulchella			
Hibbertia tontoutensis Guillaumin			
Hibbertia sp. indet.			

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
		native	Ericaceae (incl. Epacridaceae)
		native	Euphorbiaceae
		native	Fabaceae, Mimosoideae (= Mimosaceae)
		native	Goodeniaceae
		native	
		native	
		native	Loganiaceae
		native	Malpighiaceae
		native	Myrtaceae
		native	
		native	
		native	
		native	
		native	Onagraceae
		native	Orchidaceae
		native	Proteaceae
		native	Rubiaceae
		native	Sapotaceae
		native	Tiliaceae
		native	Violaceae
		introduced	Amaranthaceae
		introduced	Anacardiaceae
		introduced	Asteraceae
		introduced	
		introduced	
		introduced	
		introduced	
		introduced	
		introduced	
		introduced	Brassicaceae
		introduced	Euphorbiaceae
		introduced	
		introduced	Fabaceae, Caesalpinioideae (= Caesalpiniaceae)
		introduced	Fabaceae, Mimosoideae (= Mimosaceae)
		introduced	
		introduced	Malvaceae

Table 1. Continued, Extended.

		Bee collection data	
Plant species	Plant voucher information	♀	♂
Styphelia Sm. sp. indet., cf. *S. cymbulae* (Labill.) Spreng.		♀ 1/1	–
sp. indet.		♀ 1/1	♂ 1/4
Acacia spirorbis Labill.		♀ 4/13 (4/8 p)	♂ 1/1
Scaevola beckii Zahlbr.		♀ 2/2 p	–
Scaevola montana Labill.	(2 ♀ [1 ♀ p]) *G. McPherson 2966*, MO; (3 ♀ [2 ♀ p]) *G. McPherson 3254*, MO; (5 ♀ p) *G. McPherson 3260*, MO; (3 ♀ [1 ♀ p]) *G. McPherson 3281*, MO; (1 ♀ p) *G. McPherson 3779*, MO	♀ 9/18 (7/11 p)	♂ 1/1
Scaevola L. sp. indet.	*J. Munzinger 864*, NOU; *J. Munzinger 1382*, NOU; (2 ♀) *J. Munzinger 2958*, NOU	♀ 4/4 (1/1 p)	–
Geniostoma densiflora Baill.	*G. McPherson 3282*, MO	♀ 1/1	–
Acridocarpus austrocaledonicus Baill.	*J. C. Bradford 1053*, MO	♀ 1/1 p	–
Melaleuca quinquenervia (Cav.) S. T. Blake		♀ 2/5 p	–
Metrosideros operculata Labill. var. *operculata*	*G. McPherson 3786*, MO	♀ 1/1	–
Sannantha leratii (Schltr.) Peter G. Wilson [≡ *Babingtonia leratii* (Schltr.) A. R. Bean]		♀ 4/11 (1/2 p)	–
Sannantha virgata (J. R. Forst. & G. Forst.) Peter G. Wilson [≡ *Babingtonia virgata* (J. R. Forst. & G. Forst.) F. Muell.]	*J. Munzinger 2652*, NOU	♀ 1/1	–
Xanthostemon F. Muell. sp. indet.		–	♂ 1/1
Ludwigia octovalvis (Jacq.) P. H. Raven subsp. *octovalvis*	(2 ♀ p) *G. McPherson 3785*, MO	♀ 2/3 (1/2 p)	–
Eriaxis rigida Rchb. f.		♀ 1/1	–
Stenocarpus phyllodineus S. Moore	*G. McPherson 3317*, MO	♀ 1/1 p	–
Normandia neocaledonica Hook. f.		♀ 1/1	–
Leptostylis petiolata Vink		–	♂ 1/1
Corchorus L. sp. indet.		♀ 1/1	–
Agatea longipedicellata (Baker f.) Guillaumin & Thorne	*J. Munzinger 320*, NOU	♀ 1/1 (1/1 p)	–
Achyranthes aspera L.	*G. McPherson 3246*, MO	♀ 1/1	–
Schinus terebinthifolia		–	♂ 1/1
Bidens pilosa L.		♀ 1/1	♂ 1/1
Conyza Less. sp. indet., cf. *C. bonariensis* (L.) Cronquist		♀ 1/1	–
Calendula L. sp. indet.		♀ 1/1 p	–
Emilia sonchifolia (L.) DC.	(2 ♀ [1♀ p]) *G. McPherson 3267A*, MO	♀ 3/4 (1/1 p)	–
Tridax procumbens L.		♀ 3/13 (2/12 p)	–
Tridax L. sp. indet.		♀ 1/11 (1/6 p)	♂ 1/2
Youngia japonica (L.) DC.		♀ 1/1	–
Lepidium virginicum L.		♀ 1/1	–
Euphorbia hypericifolia L.		♀ 4/4 (3/4 p)	♂ 5/5
Euphorbia lophogona Lam.		♀ 1/1 p	–
Crotalaria L. sp. indet.	*J. Munzinger 445*, NOU	♀ 1/1	–
Leucaena leucocephala (Lam.) de Wit	(19 ♀ [15 ♀ p]) *G. McPherson 3237*, MO	♀ 4/30 (4/24 p)	–
Mimosa diplotricha C. Wright	(5 ♀ p) *G. McPherson 3776*, MO	♀ 2/6 p	–
Sida acuta Burm. f.		♀ 1/5 (1/4 p)	♂ 1/3

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
		introduced	
		introduced	Onagraceae
		introduced	Papaveraceae
		introduced	Solanaceae
		introduced	
		introduced	
		introduced	Verbenaceae
		introduced	
		introduced	
		introduced	Zygophyllaceae
Homalictus cocos Pauly & Munzinger, 2003	New Caledonia, St. Louis, 1 ♀, 17 Aug. 1940, *F. X. Williams s.n.*, IRD	native	Araliaceae
		native	Arecaceae
		introduced	Anacardiaceae
			Euphorbiaceae
			Verbenaceae
Homalictus risbeci (Cockerell, 1929)	New Caledonia, Nepoui Valley, 10 ♀, July 1940, *F. X. Williams s.n.*, IRD	native	Araliaceae
		native	
		native	
		native	Asteraceae
		native	Cunoniaceae
		native	
		native	
		native	
		native	
		native	Dilleniaceae
		native	
		native	
		native	Ericaceae (incl. Epacridaceae)
		native	Fabaceae, Mimosoideae (= Mimosaceae)
		native	Goodeniaceae
		native	
		native	
		native	
		native	Laxmanniaceae (treated as Agavaceae in Jaffré et al., 2001, 2004)
		native	Liliaceae
		native	Linaceae
		native	Malpighiaceae
		native	Malvaceae
		native	Melastomataceae
		native	Myrtaceae
		native	
		native	
		native	
		native	
		native	
		native	Onagraceae
		native	Proteaceae
		native	

Table 1. Continued, Extended.

Plant species	Plant voucher information	Bee collection data ♀	♂
Sida rhombifolia L.		♀ 7/7	–
Bougainvillea Comm. ex Juss. sp. indet.		–	♂ 1/1
Argemone mexicana L.	*G. McPherson 3255*, MO	♀ 2/16 (2/9 p)	–
Solanum lycopersicum L.	*J. Munzinger 609*, NOU	♀ 2/2 (1/1 p)	–
Solanum torvum Sw.		♀ 1/9 (1/6 p)	–
Solanum L. sp. indet.		♀ 1/1	–
Duranta repens L.		♀ 1/1	♂ 1/1
Stachytarpheta indica (L.) Vahl		♀ 1/1	♂ 1/8
Verbena L. sp. indet.		♀ 1/11 (1/7 p)	♂ 1/1
Tribulus cistoides L.		♀ 9/15 (6/12 p)	♂ 1/1
Meryta J. R. Forst. & G. Forst. sp. indet.		♀ 1/1	–
Cocos nucifera		♀ 2/2	–
Schinus terebinthifolia		♀ 2/3 (2/2 p)	♂ 2/12
Poinsettia Graham sp. indet.		♀ 3/3	♂ 1/1
Verbena sp. indet.		♀ 1/1	–
Polyscias sessiliflora Marais subsp. indet.		–	♂ 1/1
Polyscias sp. indet.		♀ 2/6 (2/5 p)	♂ 2/9
genus and sp. indet.		–	♂ 1/1
Blumea lacera		♀ 1/1	–
Geissois sp. indet.		–	♂ 1/1
Pancheria alaternoides Brongn. & Gris	*J. Munzinger 2818*, NOU	♀ 1/1	–
Pancheria billardierei		♀ 1/1	–
Pancheria phylliraeoides Brongn. & Gris ex Guillaumin	*G. McPherson 3339*, MO	♀ 1/6 p	–
Pancheria Brongn. & Gris sp. indet.		–	♂ 1/1
Hibbertia lucens	(2 ♀) *G. McPherson 3272*, MO; (1 ♀) *J. Munzinger 959*, NOU	♀ 2/3 p	–
Hibbertia pancheri (Brongn. & Gris) Briq.		♀ 1/1	–
Hibbertia sp. indet.		♀ 1/1	–
Dracophyllum verticillatum Labill.	*J. Munzinger 2957*, NOU	♀ 0/2	♂ 4/4
Acacia spirorbis		♀ 1/2 p	–
Scaevola beckii		♀ 1/1	–
Scaevola cylindrica Schltr. & K. Krause		–	♂ 1/2
Scaevola montana	(1 ♂) *G. McPherson 3260*; (1 ♀, 1♂) *G. McPherson 3779*, MO	♀ 1/1	♂ 3/3
Scaevola sp. indet.		♀ 1/1	–
Cordyline Comm. ex R. Br. sp. indet.		–	♂ 2/2
Rhuacophila javanica Blume	*J. Munzinger 3046*, NOU	♀ 1/1	–
Hugonia penicillanthemum Baill. ex Pancher & Sebert	*G. McPherson 3270*, MO	♀ 1/1 p	–
Tristellateia australasiae A. Rich.		♀ 1/1 p	–
Melochia odorata L. f.	*G. McPherson 3267*, MO	♀ 2/5 (1/2 p)	♂ 2/3
Melastoma malabathricum L. subsp. *malabathricum*		♀ 4/4	♂ 1/1
Cloezia floribunda Brongn. & Gris		–	♂ 2/2
Melaleuca quinquenervia		♀ 4/11 (3/10 p)	♂ 3/36
Metrosideros operculata	*G. McPherson 3786*, MO	♀ 1/3 p	–
Sannantha leratii		♀ 3/3 (1/1 p)	♂ 13/24
Syzygium P. Browne ex Gaertn. sp. indet.		♀ 1/2 (1/1 p)	♂ 1/1
Tristaniopsis calobuxus Brongn. & Gris		♀ 1/1 p	♂ 1/1
Ludwigia octovalvis subsp. *octovalvis*	*G. McPherson 3785*, MO	♀ 2/2	♂ 1/1
Grevillea R. Br. ex Knight sp. indet.		–	♂ 1/1
Stenocarpus phyllodineus	*G. McPherson 3317*, MO	♀ 1/2	♂ 1/1

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
		native	Rhizophoraceae
		native	Rubiaceae
		native	Sapindaceae
		native	
		native	Surianaceae
		introduced	Asteraceae
		introduced	Brassicaceae
		introduced	Fabaceae, Caesalpinioideae (= Caesalpiniaceae)
		introduced	Fabaceae, Mimosoideae (= Mimosaceae)
		introduced	
		introduced	Fabaceae, Papilionoideae
		introduced	Lythraceae
		introduced	Rutaceae
		introduced	Verbenaceae
Homalictus Cockerell sp. indet. 4	New Caledonia, Mt. Panie Trail, 3 ♀, 2 ♂, 8–9 Feb. 1963, *C. M. Yoshimoto s.n.*, IRD	native	Cunoniaceae
		native	Dilleniaceae
		native	
		native	Ericaceae (incl. Epacridaceae)
		native	Goodeniaceae
		native	Loganiaceae
		native	Myrtaceae
		native	
		native	Rubiaceae
		native	
		native	Rutaceae
		native or introduced	Asteraceae
Homalictus sp. indet. 5	New Caledonia, Hienghene, 2 ♀, 25 Nov. 1958, *C. R. Joyce s.n.*, IRD		–
Homalictus sp. indet. 6	New Caledonia, Mou, 3 ♀, 25 Dec. 1979, *B. J. Donovan s.n.*, BJD; Houailou, near tower, 1 ♂, 25 Dec. 1979, *G. McPherson s.n.*, BJD	native	Arecaceae
		native	Boraginaceae
		native	Myrtaceae
Homalictus sp. indet. 7	New Caledonia, Mts. des Koghis, 3 ♂, Jan. 1969, *N. L. H. Krauss s.n.*, BPBM		–
Homalictus sp. indet. 8	New Caledonia, Thi River Valley, 1 ♀, 6 Nov. 1940, *F. X. Williams s.n.*, IRD	native	Araliaceae
		native	
		native	Myodocarpaceae
		native	Rhamnaceae
		native	Sapindaceae
		introduced	Asteraceae
		introduced	Sapindaceae
Homalictus sp. indet. 9	New Caledonia, Mt. Koghi, 1 ♀, Dec. 1963, *R. Straatman s.n.*, BPBM	native	Araliaceae
			Arecaceae
			Cunoniaceae
			Myrtaceae

Table 1. Continued, Extended.

Plant species	Plant voucher information	Bee collection data ♀	 ♂
Rhizophora apiculata Blume	*J. Munzinger 2959*, NOU	♀ 1/1	–
Normandia neocaledonica		♀ 1/1 p	–
Cupaniopsis myrmoctona Radlk.	*J. Munzinger 4219*, NOU	♀ 1/1 p	–
Guioa villosa Radlk.		♀ 2/3 p	–
Suriana maritima L.	*G. McPherson 3245*, MO	♀ 1/1	–
Cosmos sulphureus Cav.		♀ 1/1	–
Brassica L. sp. indet.		♀ 2/4 (1/2 p)	–
Cassia fistula L.		♀ 1/1 p	–
Leucaena leucocephala		♀ 7/21 (7/20 p)	–
Mimosa diplotricha	*G. McPherson 3776*, MO	♀ 1/1 p	–
Crotalaria L. sp. indet.		♀ 1/1	–
Lagerstroemia indica L.		♀ 1/1	–
Citrus L. sp. indet.		♀ 1/8 p	–
Stachytarpheta Vahl sp. indet.		♀ 1/1	–
Pancheria robusta Guillaumin	*G. McPherson 3277D*, MO	♀ 2/4 p	–
Hibbertia lucens	*J. Munzinger 959*, NOU	♀ 2/2 (1/2 p)	–
Hibbertia trachyphylla Schltr.		–	♂ 1/3
Dracophyllum involucratum Brongn. & Gris		♀ 1/1 p	–
Scaevola beckii		♀ 1/1 p	–
Geniostoma densiflorum	*G. McPherson 3268*, MO	♀ 1/1 p	–
Metrosideros operculata var. *francii* J. W. Dawson		♀ 1/1	–
Metrosideros punctata J. W. Dawson		♀ 1/1 p	–
Normandia neocaledonica		♀ 1/1 p	–
Psychotria rupicola (Baill.) Schltr.	*G. McPherson 3277A*, MO	♀ 1/3 p	–
Zanthoxylum L. sp. indet.	*J. Munzinger 2567*, NOU	–	♂ 1/1
sp. indet.		♀ 1/1	–
–		–	–
Cocos nucifera		♀ 1/3 p	–
Heliotropium foertherianum Diane & Hilger		♀ 1/1	–
Sannantha leratii		–	♂ 1/1
–			
Polyscias sessiliflora subsp. indet.		♀ 1/1 p	–
Polyscias sp. indet.		♀ 1/5 p	–
Myodocarpus Brongn. & Gris sp. indet.	*P. Lowry 6509*, MO	♀ 1/1	–
Alphitonia neocaledonica (Schltr.) Guillaumin	*J. Munzinger 2006*, NOU	♀ 4/4	–
Guioa villosa		♀ 1/1 p	–
Ageratum L. sp. indet.		♀ 1/1 p	–
Litchi chinensis		♀ 2/3	–
Polyscias sessiliflora subsp. indet.		♀ 1/4 p	–
Schefflera vieillardii Baill.		♀ 1/1	–
Cyphokentia cerifera (H. E. Moore) Pintaud & W. J. Baker		♀ 1/1	–
Cunonia balansae Brongn. & Gris	*J. Munzinger 2520*, NOU	♀ 1/1	–
Geissois racemosa Labill.	*J. Munzinger 2680*, NOU	♀ 1/1	–
Metrosideros Banks ex Gaertn. sp. indet.		♀ 1/6 p	–

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
Homalictus sp. indet. 10	New Caledonia, Col de Roussettes, 1 ♀, 4–6 Feb. 1963, *G. Kuschel s.n.*, BPBM		–
Homalictus sp. indet. 11	New Caledonia, Île.Mouac, 1 ♂, 19 Oct. 1958, *C. R. Joyce s.n.*, IRD		–
Lasioglossum polygoni (Cockerell, 1929), subsp. indet. 1, subg. *Chilalictus*	New Caledonia, Col d'Amieu, 21 July 1977, *A. Delobeli s.n.*, ♀ holotype and 2 ♀ paratypes, MNHNP	native	Araliaceae
		native	Arecaceae
		native	Cunoniaceae
		native	Dilleniaceae
		native	Ericaceae (incl. Epacridaceae)
		native	Melastomataceae
		native	Myrtaceae
		native	Phellinaceae
		introduced	Sapindaceae
		introduced	Verbenaceae
Lasioglossum polygoni subsp. indet. 2, subg. *Chilalictus*	New Caledonia, Haute-Ni, 1 ♀, 23 Oct. 2004, *J. Munzinger s.n.*, MNHNP	native	Araliaceae
		native	
		native	
		native	Cunoniaceae
		native	Dilleniaceae
		native	Elaeocarpaceae
		native	
		native	Ericaceae (incl. Epacridaceae)
		native	Goodeniaceae
		native	Myrtaceae
		native	Sapindaceae
		native	
		native	
		introduced	Asteraceae
		introduced	Fabaceae, Mimosoideae (= Mimosaceae)
		introduced	Sapindaceae
Lasioglossum polygoni subsp. indet. 3, subg. *Chilalictus*	New Caledonia, Bourail, 27 May 1927, *T. D. A. Cockerell s.n.*, 1 ♀ holotype, MNHNP	native	Asteraceae
		native	Elaeocarpaceae
		native	Violaceae
		introduced	Malvaceae
			Polygonaceae
			Solanaceae
Lasioglossum Curtis sp. indet. 4, subg. *Chilalictus*	New Caledonia, Forêt de Sailles, 1 ♀, 9 Dec. 2001, *J. Munzinger s.n.*, MNHNP	native	Apocynaceae
			Araliaceae
			Dilleniaceae
			Ericaceae (incl. Epacridaceae)
			Liliaceae
			Phellinaceae
Lasioglossum sp. indet. 5, subg. *Chilalictus*	New Caledonia, Mt. Khogis, 22 Dec. 1992, *M. E. Irwin & D. W. Webb s.n.*, INHS-96,625 (1 ♀), INHS-96,607 (1 ♂)		–

Table 1. Continued, Extended.

		Bee collection data	
Plant species	Plant voucher information	♀	♂
–		–	–
–		–	–
Polyscias dioica (Vieill. ex Pancher & Sebert) Harms	*J. Munzinger 1732*, NOU	♀ 3/3	–
Cyphokentia cerifera		♀ 2/2	–
Geissois racemosa	*J. Munzinger 2680*, NOU	♀ 4/4	–
Hibbertia lucens	(1 ♀) *J. Munzinger 959*, NOU	♀ 2/2	–
Dracophyllum ramosum Pancher ex Brongn. & Gris	*J. Munzinger 2043*, NOU	–	♂ 1/1
Melastoma malabathricum subsp. *malabathricum*		♀ 13/13 (1/14 p)	–
Myrtastrum rufopunctatum (Pancher ex Brongn. & Gris) Burret		♀ 1/1	–
Phelline lucida Vieill. ex Baill.	*J. Munzinger 2502*, NOU	♀ 2/2	–
Litchi chinensis		♀ 1/1 p	–
Lantana L. sp. indet		♀ 1/3	–
Polyscias dioica	*J. Munzinger 1732*, NOU	♀ 1/1	–
Polyscias sessiliflora subsp. indet.		♀ 1/2 p	–
Polyscias sp. indet.		♀ 3/12 (3/11 p)	–
Pancheria sebertii Guillaumin		♀ 1/1	–
Hibbertia nana Däniker		♀ 1/1	–
Elaeocarpus dognyensis Guillaumin		♀ 1/1	–
Elaeocarpus speciosus Brongn. & Gris.	*J. Munzinger 3058*, NOU	♀ 2/2	–
Styphelia cf. *cymbulae* Spreng.	*J. Munzinger 2495*, NOU	♀ 1/1	–
Scaevola beckii		♀ 2/3 (1/1 p)	–
Syzygium quadrangulare		♀ 1/2 p	–
Cupaniopsis oedipoda Radlk.	*G. McPherson 3227*, MO	♀ 1/1 p	–
Cupaniopsis Radlk. sp. indet.	*G. McPherson 2744*, MO	♀ 1/2 p	–
Guioa villosa	*G. McPherson 3238*, MO	♀ 1/1 p	–
Ageratum conyzoides L.		♀ 4/19 p	–
Leucaena leucocephala	*G. McPherson 3237*, MO	♀ 1/1 p	–
Litchi chinensis		♀ 3/9 (1/3 p)	–
Blumea lacera		♀ 1/2 (1/1 p)	–
Elaeocarpus angustifolius		–	♂ 1/1
Agatea longipedicellata	*J. Munzinger 396*, NOU	♀ 1/1	–
Sida acuta		♀ 1/22 (1/20 p)	–
Antigonon leptopus Hook. & Arn.		♀ 2/2	–
Polygonum L. sp. indet.		♀ 1/1	–
Solanum torvum		♀ 1/4 (1/3 p)	–
Parsonsia R. Br. sp. indet.	*J. Munzinger 4051*, NOU	–	♂1/1
Polyscias dioica	*J. Munzinger 1732*, NOU	♀ 2/2	–
Hibbertia nana	*J. Munzinger 1649*, NOU	♀ 2/2	–
Dracophyllum involucratum	*F. Tronchet 609*, NOU	♀ 3/3	–
Rhuacophila javanica	*Th. Le Borgne 39*, NOU	♀ 3/3	–
Phelline lucida	*J. Munzinger 2502*, NOU	♀ 1/1	–
–		–	–

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
Lasioglossum sp. indet. 6, subg. *Chilalictus*	New Caledonia, Upper Vallée La Ni, 2 ♀, 2 Nov. 1992, *M. E. Irwin & D. W. Webb s.n.*, INHS-96,626, INHS-96,627		–
Lasioglossum sp. indet. 7, subg. *Chilalictus*	New Caledonia, Vallée de la Tchamba, 1 ♀, 26 July 2005, *J. Munzinger s.n.*, MNHNP	native	Melastomataceae
Lasioglossum sp. indet. 8, subg. *Chilalictus*	New Caledonia, Ni Valle, 1 ♀, 2 Nov. 1992, *M. E. Irwin & D. W. Webb s.n.*, INHS-96,642		–
Lasioglossum sp. indet. 9, from an undescribed subgenus	New Caledonia, Haute-Ni, 1 ♀, 23 Oct. 2004, *J. Munzinger s.n.*, MNHNP	native	Ericaceae (incl. Epacridaceae)
Lasioglossum sulthicum (Smith, 1853), subg. *Parasphecodes* Smith	Australia, Mt. Kogis, 1 ♀, 30 Oct. 1992, *M. E. Irwin & D. W. Webb s.n.*, INHS-96,695		–
Nomiinae			
Austronomia cheesmanae (Michener, 1965)	New Caledonia, Lifu, Cape des Pins, 18 Nov. 1950, *L. E. Cheesman s.n.* (1 ♀), holotype, BMNH	native	Myoporaceae
Austronomia sicheli (Vachal, 1897)	New Caledonia, 1 ♀, s.d., *J. Sichel s.n.*, MNHNP	native	Apocynaceae
		native	Araliaceae
		native	
		native	
		native	Celastraceae
		native	Combretaceae
		native	Connaraceae
		native	Cunoniaceae
		native	Dilleniaceae
		native	
		native	
		native	
		native	
		native	Ericaceae (incl. Epacridaceae)
		native	
		native	
		native	Escalloniaceae
		native	Fabaceae, Caesalpinioideae
		native	
		native	
		native	
		native	Fabaceae, Mimosoideae (= Mimosaceae)
		native	Goodeniaceae
		native	
		native	
		native	
		native	Joinvilleaceae

Table 1. Continued, Extended.

		Bee collection data	
Plant species	Plant voucher information	♀	♂
–		–	–
Melastoma malabathricum subsp. *malabathricum*		♀ 1/1	♂ 1/1
–		–	–
Styphelia cf. *cymbulae*	*J. Munzinger 2495*, NOU	♀ 1/1	–
–		–	–
Myoporum crassifolium G. Forst.		♀1/1	–
Parsonsia crebriflora Baill.	*J. Munzinger 1733*, NOU	♀ 6/6	–
Polyscias sessiliflora subsp. indet.		♀ 1/5 p	–
Polyscias sp. indet.		♀ 1/5 (1/3 p)	–
sp. indet. 1		♀ 1/2	–
Peripterygia marginata	*G. McPherson 3284*, MO	♀ 1/1	–
Lumnitzera racemosa Willd.	*J. Munzinger 2668*, NOU	–	♂ 2/2
sp. indet. 1		♀ 2/3 p	–
Codia discolor (Brongn. & Gris) Guillaumin	*J. Munzinger 2651*, NOU	♀ 2/2 p	–
Hibbertia bouletii Veillon		?1/1	?1/1
Hibbertia lucens	(4 ♀ p) *G. McPherson 3272*, MO; (4 ♀) *J. Munzinger 959*; (1 ♀) *J. Munzinger 2527*, NOU	♀ 6/9 (6/6 p)	–
Hibbertia pancheri		♀ 1/1	–
Hibbertia pulchella		♀ 2/2	–
Hibbertia sp. indet.	(2 ♀ p) *J. C. Bradford 1116*, MO	♀ 3/9 (3/7 p)	–
Dracophyllum verticillatum		♀ 0/1	–
Styphelia pancheri (Brongn. & Gris) F. Muell.	*J. Munzinger 395*, NOU	♀ 1/1	–
Styphelia cf. *cymbulae*	*J. Munzinger 2495*, NOU	♀ 2/2	–
Argophyllum montanum Schltr.	*G. McPherson 3269*, MO	♀ 1/1 p	–
Cassia fistula		♀ 1/3 p	–
Cassia L. sp. indet.		♀ 3/4 (3/3 p)	–
Storckiella pancheri Baill.		♀ 1/1 p	–
Storckiella Seem. sp. indet.		♀ 2/4 (2/3 p)	–
Acacia spirorbis		♀ 2/2 p	♂ 1/1
Scaevola beckii		♀ 2/3 (1/1 p)	–
Scaevola cylindrica	(1♀, 1♂) *G. McPherson 2300*, MO	♀ 2/2	♂ 2/3
Scaevola erosa Guillaumin ex I. H. Müll.		♀ 1/1	–
Scaevola montana	(1 ♀) *G. McPherson 3260*, MO; (9 ♀) *G. McPherson 3281*, MO; (1 ♂) *G. McPherson 3779*, MO; (1 ♀) *J. Munzinger 4725*, NOU	♀ 5/12	♂ 2/2
Joinvillea Gaudich. ex Brongn. & Gris sp. indet.		♀ 1/2 p	–

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
		native	Loganiaceae
		native	Malpighiaceae
		native	Melastomataceae
		native	
		native	Myodocarpaceae
		native	Myrsinaceae
		native	Myrtaceae
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	
		native	Proteaceae
		native	
		native	
		native	
		native	Rhamnaceae
		native	Rubiaceae
		native	Sapindaceae
		native	
		native	Violaceae
		introduced	Anacardiaceae
		introduced	Asteraceae
		introduced	Euphorbiaceae
		introduced	Fabaceae, Mimosoideae (= Mimosaceae)
		introduced	
		introduced	Fabaceae, Papilionoideae
		introduced	Lamiaceae
		introduced	Myrtaceae
		introduced	
		introduced	Phrymaceae
		introduced	Sapindaceae
		introduced	Solanaceae
		introduced	
		introduced	Verbenaceae
		native or introduced	Convolvulaceae
Austronomia (L.) Link sp. indet. 3	New Caledonia, Mt. Do, 1 ♀, 15 Dec. 2000, *B. J. Donovan s.n.*, BJD	introduced	Fabaceae, Papilionoideae
Austronomia sp. indet. 4	New Caledonia, Loyalty Islands, Lifu Island, 1 ♀, 26–27 Mar. 1968, *J. L. Gressit & T. C. Maa s.n.*, BPBM		–

Table 1. Continued, Extended.

Plant species	Plant voucher information	Bee collection data	
		♀	♂
Geniostoma densiflorum	*G. McPherson 3282*, MO	♀ 1/3	–
Tristellateia australasiae		♀ 1/1	–
Melastoma denticulatum Labill.		♀ 2/5 (1/3 p)	–
Melastoma malabathricum subsp. *malabathricum*		♀ 4/5 (1/2 p)	–
Myodocarpus fraxinifolius		♀ 2/1 (2/2 p)	♂ 1/3
Tapeinosperma oblongifolium Mez	*J. Munzinger 1954*, NOU		
Cloezia artensis (Montrouz.) P. S. Green	(3 ♀, 4 ♂) *G. McPherson 3258*, MO	♀ 1/3	♂ 3/5
Cloezia Brongn. & Gris sp. indet.		♀ 1/4	♂ 1/1
Melaleuca gnidioides Brongn. & Gris		♀ 1/2 p	–
Melaleuca quinquenervia		♀ 3/4 (2/3 p)	♂ 3/8
Myrtastrum rufopunctatum		♀ 1/1	–
Myrtus L. sp. indet.		–	♂ 1/73
Sannantha leratii		♀ 9/14	♂ 3/17
Sannantha Peter G. Wilson sp. indet.	*J. Munzinger 456*, NOU	–	♂ 1/1
Syzygium lateriflorum Brongn. & Gris		♀ 3/12 (1/3 p)	♂ 1/1
Syzygium quadrangulare		♀ 1/2 (1/1 p)	–
Tristaniopsis calobuxus		♀ 2/5	♂ 3/10
Tristaniopsis glauca Brongn. & Gris		♀ 1/1	–
Tristaniopsis vieillardii Brongn. & Gris	*J. Munzinger 4679*, NOU	♀ 1/1	–
Uromyrtus emarginata (Panch. ex Brongn. & Gris) Burret	*J. Munzinger 394*, NOU	♀ 1/1	–
sp. indet. 1		♀ 1/1 p	–
sp. indet. 2	*J. C. Bradford 1115*, MO	♀ 1/2 p	–
Grevillea exul Lindl.	*G. McPherson 3271*, MO	♀ 2/8 (2/4 p)	–
Stenocarpus milnei Hook.	*G. McPherson 3285*, MO	♀ 2/14 (1/1 p)	♂ 2/4
Stenocarpus umbelliferus Druce		♀ 1/1	–
Stenocarpus R. Br. sp. indet.		♀ 1/1 p	♂ 1/6
Alphitonia neocaledonica	*J. Munzinger 2006*, NOU	♀ 1/1	–
Normandia neocaledonica	*G. McPherson 3221*, MO	♀ 1/1 p	–
Guioa villosa		♀ 2/2 p	–
Storthocalyx pancheri (Baill.) Radlk.	*J. Munzinger 2053*, NOU	? 1/1	? 1/1
Agatea longipedicellata	*J. Munzinger 320*, NOU	♀ 20/20 p	♂ 11/11
Schinus terebinthifolia	(3 ♀ [1 ♀ p]) *G. McPherson 3241*, MO	♀ 5/9 (3/3 p)	♂ 1/8
Ageratum conyzoides		♀ 3/17 (3/13 p)	–
Poinsettia sp. indet.		♀ 2/2	♂ 1/1
Leucaena leucocephala		♀ 5/12 p	–
Mimosa diplotricha	*G. McPherson 3776*, MO	♀ 1/1	–
Senna occidentalis (L.) Link		♀ 1/1 p	–
Mentha L. sp. indet.		♀ 1/2	–
Psidium guajava L.		♀ 1/8 (1/5 p)	–
Syzygium jambolanum (Lam.) DC.		♀ 1/2	–
Mimulus L. sp. indet.		♀ 1/1	–
Litchi chinensis		♀ 1/1	–
Solanum torvum	(1 ♀ p) *G. McPherson 3766B*, MO	♀ 3/12 p	–
sp. indet. 1		♀ 2/13 p	–
Stachytarpheta indica		♀ 1/1	–
Ipomoea L. sp. indet.		♀ 1/2 p	–
Senna occidentalis		♀ 1/1	–
–		–	–

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
Austronomia sp. indet. 5	New Caledonia, Mt. Koghis, 1 ♂, 22 Dec. 1992, *M. Irwin & D. W. Webb s.n.*, INHS		–
Megachilidae			
Megachilinae			
Lithurgini			
Lithurgus scabrosus (Smith, 1859), subg. *Lithurgus* Berthold	Ile Aru, Indonesia, Noumea, 1 ♂, July 1900, *J. J. Walker s.n.*, MNHNP	native	Convolvulaceae
		native or introduced	Convolvulaceae
Megachilini			
Megachile laticeps Smith, 1853, subg. *Aethomegachile* Engel & Baker	Iles Phillipines, Noumea, 1 ♀, July 1957, *J. Rageau s.n.*, MNHNP	native	Convolvulaceae
		native	Myrtaceae
		introduced	Verbenaceae
Megachile rambutwan Cheesman, 1936, subg. *Callomegachile* Michener	Vanuatu, Noumea, 1 ♂, Aug. 1900, *J. J. Walker s.n.*, MNHNP		
Megachile umbripenne Smith, 1853, subg. *Callomegachile*	Nepal, Noumea, 2 ♀, 15 Oct. 1980, *B. J. Donovan s.n.*, BJD	native	Proteaceae
		introduced	Asteraceae
		introduced	Fabaceae, Papilionoideae
		introduced	Polygonaceae
		introduced	Verbenaceae
Megachile albomarginata Smith, 1879, subg. *Eutricharaea* Thomson	New Caledonia, Mt. Mou, 1 ♀, 12 Mar. 1914, *P. D. Montague 541*, MNHN	native	Apocynaceae
		native	
		native	
		native	Araliaceae
		native	Connaraceae
		native	Dilleniaceae
		native	
		native	
		native	Goodeniaceae
		native	
		native	
		native	Myrtaceae
		native	Proteaceae
		native	Violaceae
		native	
		introduced	Asteraceae
		introduced	
		introduced	
		introduced	
		introduced	Fabaceae, Mimosoideae (= Mimosaceae)
		introduced	
		introduced	
		introduced	Lamiaceae
		introduced	Myrtaceae
		introduced	
		introduced	Tiliaceae
		introduced	Verbenaceae
		introduced	

Table 1. Continued, Extended.

Plant species	Plant voucher information	Bee collection data	
		♀	♂
–		–	–
Ipomoea pes-caprae (L.) R. Br.		♀ 2/2	♂ 2/2
Ipomoea sp. indet.		♀ 2/4 (1/2 p)	♂ 1/8
Ipomoea pes-caprae		♀ 1/1	♂ 1/7
Sannantha pinifolia (Labill.) Peter G. Wilson [≡ *Babingtonia pinifolia* (Labill.) A. R. Bean]		♀ 0/1	–
Duranta repens		–	♂ 0/2
–	–	–	–
Stenocarpus sp. indet.		♀ 1/7 (1/4 p)	♂ 1/3
Bidens pilosa		–	♂ 2/8
Cytisus cajan L.	*G. McPherson 3240*, MO	♀ 1/2 (1/1 p)	–
Antigonon leptopus		–	♂ 3/3
Duranta repens		–	♂ 2/2
Parsonsia crebriflora	*J. Munzinger 1733*, NOU	♀ 1/1 p	–
Rauvolfia semperflorens (Müll. Arg.) Schltr.	*G. McPherson 3235*, MO	♀ 1/1	♂ 1/2
sp. indet.		♀ 1/1 p	–
Tieghemopanax R. Vig. sp. indet.	*G. McPherson 3787*, MO	♀ 1/1 p	–
sp. indet. 1		♀ 1/1 p	–
Hibbertia podocarpifolia		♀ 1/2 p	–
Hibbertia lucens	(2 ♀) *J. Munzinger 959*, NOU; (1 ♀) *J. Munzinger 2527*, NOU	♀ 4/5 (2/5 p)	–
Hibbertia sp. indet.		♀ 1/1	–
Scaevola beckii		♀ 1/1 p	–
Scaevola erosa		♀ 2/2 (1/1 p)	–
Scaevola montana	(2 ♂) *G. McPherson 3236*, MO; (1 ♀ 3 ♂) *G. McPherson 3779*, MO	♀ 1/1 p	♂ 3/5
Syzygium lateriflorum		–	♂ 1/1
Stenocarpus sp. indet.		♀ 1/1	-
Agatea longipedicellata	*J. Munzinger 320*, *396*, NOU	♀ 8/8	♂ 1/1
Agatea rufotomentosa (Baker f.) J. Munzinger	*J. Munzinger 370*, *371*, NOU	♀ 2/2 (1/2 p)	–
Ageratum sp. indet.		♀ 2/2 (1/1 p)	–
Bidens L. sp. indet.		–	♂ 1/1
Cosmos Cav. sp. indet.		♀ 1/3	-
Tridax procumbens		–	♂ 1/1
Albizia Durazz. sp. indet.		♀ 1/6 (1/5 p)	–
Leucaena leucocephala	(1 ♀ p) *G. McPherson 3237*, MO	♀ 2/4 p	–
Mimosa diplotricha	*G. McPherson 3776*, MO	♀ 1/1 p	–
Ocimum gratissimum L.	*G. McPherson 3267C*, MO	♀ 1/1 p	–
Psidium guajava		♀ 1/1 p	–
Callistemon R. Br. sp. indet.		♀ 0/1	–
Triumfetta rhomboidea Jacq.		♀ 1/1 p	–
Duranta repens		–	♂ 1/1
Stachytarpheta indica	(3 ♀ [1 ♀ p] 2 ♂) *G. McPherson 3249*, MO	♀ 2/4 (1/1 p)	♂ 5/8

Table 1. Continued.

Bee family, subfamily, tribe, genus, and species	Insect voucher information	Plant origin	Plant family
Megachile australasiae Dalla Torre, 1896, subg. *Eutricharaea*	Australia, species not seen		–
Megachile australis Lucas, 1876, subg. *Eutricharaea*	New Caledonia, Noumea, 1 ♀, June 1900, *J. J. Walker s.n.*, MNHNP	native	Aizoaceae
		native	Apocynaceae
		native	
		native	Asteraceae
		native	Convolvulaceae
		native	Dilleniaceae
		native	Euphorbiaceae
		native	Fabaceae, Papilionoideae
		native	Goodeniaceae
		native	Labiatae
		native	Myrtaceae
		native	
		native	
		native	Onagraceae
		native	Santalaceae
		native	Surianaceae
		introduced	Amaranthaceae
		introduced	Asteraceae
		introduced	
		introduced	
		introduced	
		introduced	
		introduced	Euphorbiaceae
		introduced	Fabaceae, Mimosoideae (= Mimosaceae)
		introduced	
		introduced	Myrtaceae
		introduced	Poaceae
		introduced	Tiliaceae
		introduced	Verbenaceae
		introduced	Zygophyllaceae
Megachile fullawayi Cockerell, 1914, subg. *Eutricharaea*	Guam, Noumea, 1 ♂, July 1914, *F. X. Williams s.n.*, MNHNP		–
Megachile aurantiaca Friese, 1905, subg. *Hackeriapis* Cockerell	New Caledonia, Dumbea, 1 ♂, 19 Dec. 1979, *B. J. Donovan s.n.*, BJD	native	Apocynaceae
		native	Fabaceae, Papilionoideae
		native	Flacourtiaceae
		native	Liliaceae
		native	Violaceae
Apidae			
Xylocopinae			
Ceratina dentipes Friese, 1914, subg. *Neoceratina* Perkins	Java, Buitenzorg, 16 km SE La Foa, 1 ♀, 20–22 Dec. 1991, *M. E. Irwin, D. W. Webb s.n.*, INHS-22,419	introduced	Verbenaceae

Table 1. Continued, Extended.

Plant species	Plant voucher information	Bee collection data ♀	Bee collection data ♂
–		–	–
Sesuvium portulacastrum L.		♀ 1/1	–
Melodinus J. R. Forst. & G. Forst. sp. indet.		♀ 1/1	–
Rauvolfia semperflorens	*G. McPherson 3235*, MO	–	♂ 1/1
Tridax procumbens		♀ 6/10 (2/3 p)	♂ 1/1
Ipomoea pes-caprae		–	♂ 2/2
Tetracera billardieri Martelli	*J. Munzinger 861*, NOU	♀ 1/1 p	♂ 1/1
Cleistanthus stipitatus (Baill.) Müll. Arg.		♀ 1/1	–
Desmodium incanum DC.	*J. C. Bradford 1074*, MO	♀ 1/1 p	–
Scaevola sericea Vahl		–	♂ 1/1
Premna serratifolia L.		♀ 1/1	–
Melaleuca quinquenervia		♀ 1/1	–
Metrosideros operculata	*G. McPherson 3786*, MO	–	♂ 1/1
Sannantha sp. indet. (sensu *Babingtonia*)		♀ 1/1	–
Ludwigia octovalvis subsp. *octovalvis*	(3 ♀ [1 ♀ p] 1 ♂) *G. McPherson 3785*, MO	♀ 1/3 (1/1 p)	♂ 3/3
Santalum austrocaledonicum Vieill.	*J. Munzinger 4518*, NOU	–	♂ 1/1
Suriana maritima	*G. McPherson 3245*, MO	–	♂ 2/4
Achyranthes aspera	*G. McPherson 3246*, MO	♀ 1/1	♂ 1/2
Bidens sp. indet.		♀ 1/1	–
Cosmos sulphureus		♀ 1/1	♂ 1/1
Cosmos sp. indet.		♀ 1/3	♂ 1/1
Sphagneticola trilobata (L.) Pruski	*J. Munzinger 405*, NOU	–	♂ 2/2
Tridax procumbens	(6 ♀ [3 ♀ p]) *G. McPherson 3247*, MO	♀ 6/10 (2/3 p)	♂ 1/1
Poinsettia sp. indet.		–	♂ 1/2
Leucaena leucocephala	*G. McPherson 3237*, MO	♀ 1/1 p	♂ 1/1
Mimosa diplotricha	*G. McPherson 3776*, MO	♀ 1/2 (1/1 p)	–
Psidium guajava		♀ 1/5 p	–
Stenotaphrum secundatum (Walter) Kuntze		♀ 2/2	–
Triumfetta rhomboidea		♀ 2/6 (2/4 p)	–
Stachytarpheta australis Moldenke	*P. Lauri 128*, NOU	–	♂ 1/1
Tribulus cistoides		–	♂ 1/1
–		–	–
sp. indet. 1		–	♂ 1/1
Nephrodesmus ferrugineus Däniker	*J. Munzinger 3011*, NOU	♀ 1/1	–
Homalium betulifolium Däniker		♀ 1/1	–
Dianella sp. indet.		♀ 1/1	–
Agatea rufotomentosa	*J. Munzinger 371*, NOU	♀ 3/3	♂ 1/1
Stachytarpheta australis		♀ 1/1	–
Stachytarpheta cayennensis (Rich.) Vahl		♀ 2/2	–

Abbreviations: BJD, Personal collection of Barry J. Donovan; IRD, Institut de Research pour Développement.

Table 2. Plant families and the number of native and introduced plant genera and species visited by female bees.

Plant families	Number of plant genera	Number of plant species	Number of bee species with females visiting	Number of bee species with females carrying pollen	Number of plant species from which pollen was carried
Native plants					
Aizoaceae	1	1	1	0	0
Apocynaceae	3	4	3	2	2
Araliaceae	4	7	8	6	4
Arecaceae	2	2	5	1+1?	1+1?
Asteraceae	2	2	4	2	2
Boraginaceae	1	1	1	0	0
Celastraceae	1	1	2	0	0
Connaraceae	1	1	2	2	1
Convolvulaceae	1	1	2	0	0
Cunoniaceae	4	9	7	4+1?	4+1?
Dilleniaceae	2	10	9	6+1?	5+2?
Elaeocarpaceae	1	2	1	0	0
Ericaceae	2	3	7	1	1
Escalloniaceae	1	1	1	1	1
Euphorbiaceae	1	2	2	0	0
Fabaceae	5	7	5*	4*	6
Caesalpinoidea	2	4	1	1	4
Mimosoideae	1	1	3	3	1
Papilionoideae	2	2	2	11	1
Flacourtiaceae	1	1	1	1	0
Goodeniaceae	1	5	6	5	4
Joinvilleaceae	1	1	1	1	1
Labiatae	1	1	1	0	0
Liliaceae	2	2	3	0	0
Linaceae	1	1	1	1	1
Loganiaceae	1	1	3	1	1
Malpighiaceae	2	2	3	2	2
Malvaceae	1	1	1	1	1
Melastomataceae	1	2	4	2	2
Myodocarpaceae	1	2	1	1	1
Myoporaceae	1	1	1	0	0
Myrsinaceae	1	1	1	0	0
Myrtaceae	8	21	9	6+1?	11
Onagraceae	1	1	3	2	1
Orchidaceae	1	1	1	0	0
Phellinaceae	1	1	2	0	0
Proteaceae	2	5	5	3	4
Rhamnaceae	1	1	2	0	0
Rhizophoraceae	1	1	1	0	0
Rubiaceae	2	2	4	3	2
Sapindaceae	2	4	4	4	4
Surianaceae	1	1	1	0	0
Tiliaceae	1	1	1	0	0
Violaceae	1	2	5	3	2
Introduced plants					
Amaranthaceae	2	2	2	1	1
Anacardiaceae	1	1	2	2	1
Asteraceae	8	12	7	6	6
Brassicaceae	2	2	2	1	1
Euphorbiaceae	2	3	3	1	2
Fabaceae	8	8	8*	7*	6
Caesalpinioideae	2	2	2	1	1
Mimosoideae	3	3	6	6	3
Papilionoideae	3	3	4	2	2

Table 2. Continued.

Plant families	Number of plant genera	Number of plant species	Number of bee species with females visiting	Number of bee species with females carrying pollen	Number of plant species from which pollen was carried
Lamiaceae	2	2	2	1	1
Lythraceae	1	1	1	1	1
Malvaceae	1	2	2	2	2
Myrtaceae	3	3	3	3	1
Phrymaceae	1	1	1	0	0
Poaceae	1	1	1	0	0
Polygonaceae	2	2	1	0	0
Rutaceae	1	1	1	1	1
Sapindaceae	1	1	4	2+1?	1+1?
Solanaceae	1	3	3	3	3
Tiliaceae	1	1	2	2	1
Verbenaceae	4	7	7	2	2
Zygophyllaceae	1	1	1	1	1
Native or introduced plants (status uncertain)					
Asteraceae	1	1	1	0	0
Convolvulaceae	1	1	2	2	1

? Refers to bee species that carry pollen internally. For example, 4 + 1? means that females of four species were carrying pollen and females of one species were possibly carrying pollen internally.

* Indicates that in these columns, the numbers for the subfamilies of Fabaceae do not match the totals for Fabaceae as a whole. This is because some species of bees visit more than one subfamily.

the 28 recorded by Donovan (1983) and the 21 of Pauly and Munzinger (2003), there is uncertainty as to the number of bee species that might be truly native and the number that might have colonized the country in historic times through agencies of human transport. But if all 43 species are considered, with 3051 species of flowering plants thought to be native to New Caledonia (Morat et al., 2012), the ratio of species of bees to flowering plants is about 1:71. This is extremely low compared to Australia, which lies 1200 km to the west, where the ratio is about 1:7 (Donovan, 1983). However, for New Zealand, which is about 1600 km to the southeast, a recent assessment of 28 native species of bees (Donovan, 2007), and 1612 native species of flowering plants (Allen, 1961; Moore & Edgar, 1976) gives a ratio of 1:57, which suggests that the comparative relationships of native bees and plants of the two island countries may be rather similar.

Apart from *Lithurgus scabrosus* Smith, which is found only on *Ipomoea pes-caprae* (L.) R. Br. (Pauly & Munzinger, 2003), there appear to be no obvious specializations of any species of bees to foraging on particular flowers, and indeed the ablity of the most common species of bees to forage on at least some introduced flowers suggests that their foraging habits are quite plastic. For the uncommon species of bees, the data are too few to allow judgments.

The 116 native species of flowering plants visited by the females of New Caledonian native bees are just 3.8% of the 3051 native species of flowering plants. However, because of height from the ground, the density of foliage, and ruggedness of the landscape, many flowers are difficult to reach with insect collecting equipment, and if access were better there is no doubt that bees would be shown to visit many more flowers. Another major point is that for 20 species of bees there are no records of females associated with flowers. A primary reason for the lack of records is that for several species of bees only one or a few males were collected. Also, if females were collected and especially if very few were collected, there may be no flower records. Only half a dozen species of bees can be considered to be common and perhaps occasionally numerous, of which the primary species are listed in Table 3. A survey of flower visitors at 31 sites over Grande Terre by Kato and Kawakita (2004) found that for 541 individual Apoidea, 89.8% were the introduced honey bee *Apis mellifera*, followed by the Halictidae (6%) and Megachilidae (3%). Colletid bees were not seen. Moreover, honey bees were found in all vegetation types, at every altitude and locality. Kato and Kawakita (2004) concluded that native bees must have been abundant and played an important role in pollination before the immigration of honey bees. They suggest that native bees are now endangered

Table 3. Species of bees with females visiting native and introduced plant families, genera, and species, ranked by the highest number of plant species visited, or for those with equal scores, thereafter as listed in Table 1. Question marks refer to pollen possibly carried internally; P refers to the kleptoparasitic bees of *Lasioglossum*, an undescribed subgenus in which pollen is not collected by females.

	Numbers of visited plants			Number of plant species from which pollen was carried
Species of bee	Families	Genera	Species	
Visitors to native plants				
Austronomia sicheli	22	32	53	29
Homalictus risbeci	18	24	30	15
Homalictus aponi	18	19	27	15
Lasioglossum polygoni	12	16	21	9
Megachile albomarginata	7	8	14	10
Megachile australis	9	10	10	4
Homalictus sp. indet. 4	7	8	9	8
Homalictus sp. indet. 9	4	6	6	2
Euhesma sp. indet. 1	3	3	5	5?
Homalictus sp. indet. 8	4	4	5	3
Lasioglossum sp. indet. 4	5	5	5	0
Megachile aurantiaca	4	4	4	0
Homalictus cocos	2	2	2	0
Homalictus sp. indet. 6	2	2	2	1
Megachile laticeps	2	2	2	0
Leioproctus pacificus	1	1	1	0
Palaeorhiza flavomellea	1	1	1	1?
Lasioglossum sp. indet. 7	1	1	1	0
Lasioglossum sp. indet. 9	1	1	1	P
Lithurgus scabrosus	1	1	1	0
Megachile umbripenne	1	1	1	1
Visitors to introduced plants				
Homalictus aponi	9	19	24	14
Austronomia sicheli	10	13	14	8
Megachile australis	7	10	11	5
Megachile albomarginata	6	10	10	8
Homalictus risbeci	6	9	9	6
Lasioglossum polygoni	6	7	7	5
Homalictus cocos	3	3	3	1
Homalictus sp. indet. 8	2	2	2	1
Ceratina dentipes	1	1	2	0
Euryglossina sp. indet. 1	1	1	1	1?
Austronomia sp. indet. 3	1	1	1	0
Megachile umbrippenne	1	1	1	1
Visitors to native or introduced plants (status uncertain)				
Homalictus sp. indet. 4	4	1	1	0
Austronomia sicheli	1	1	1	1
Lithurgus scabrosus	1	1	1	1

because of competitive pressure from honey bees, and that original plant-pollinator interactions have been altered.

Although direct evidence of competitive interactions between native bees and honey bees has not yet been documented, our findings that most species of native bees are very uncommon strongly support the opinions of Kato and Kawakita (2004). Because honey bees forage for nectar and pollen whenever weather allows them to, and they are extremely polylectic, native bees in tropical New Caledonia are faced with continuous competitive foraging pressure from this introduced bee. Unless honey bee numbers are reduced, perhaps by the future occurrence of the mite *Varroa destructor* Anderson & Trueman, the survival of most of the native species of bees in New Caledonia may be uncertain, which would forever obscure the original relationships between them and the native flora.

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